CHAPTER 35

Kitchen Spices as Complementary and Alternative Medicine: Pharmacotherapeutic Potential and Challenges

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SUMMARY

Complementary and alternative medicine (CAM) recognizes the health advantages of a variety of kitchen spices, including celery, lemongrass, cardamom, saffron, cloves, garlic, cumin, cinnamon, turmeric, ginger, fenugreek, and cloves. They endow them with humor. Garlic's antimicrobial qualities are well-known for supporting heart health and thwarting illness. Because clove is an analgesic, anti-inflammatory, and nerve-healthy herb, it helps reduce pain. The antioxidant potential of Cumin can also aid in weight management and better digestion. Cinnamon which possesses anti-inflammatory and anti-diabetic qualities could support heart health and blood sugar regulation. Additionally, it treats a number of illnesses and eases joint discomfort. Ginger has anti-inflammatory and digestive properties which aid in the relief of constipation. Besides helping with blood sugar regulation, fenugreek is beneficial for nursing moms. Among the many health benefits of celery is its ability to lower inflammation and indigestion. Lemongrass is well known for its antibacterial properties, which can also reduce tension and aid with digestion. Cardamom can help with digestion and improve oral health. Saffron is widely recognized for enhancing mental health, elevating mood, and reducing symptoms of depression. These spices have many medical properties that enhance the therapeutic role of food in rituals. When combined with a balanced diet, they can provide a delicious and comprehensive way to preserve health and well-being. Before using it medicinally, you should speak with a doctor, especially if you have any specific health issues or plan to use it in conjunction with other prescriptions.

INTRODUCTION

The herbs used to make the spices are derived from a variety of plant components, including leaves, buds, blossoms, seeds, tree bark, roots, and root systems, as well as glandular substances such as resins, gums, and volatile oils. Spices are a frequent food ingredient used to give food its distinctive flavor and color, to enhance the flavor, and in some cases, to serve as a preservative (Sofowora et al., 2013). Additionally, it has some therapeutic qualities that promote human wellness and can treat illnesses through the practice of traditional Indian medicine called Ayurveda. Civilizations such as India and Pakistan have long valued spices for their therapeutic qualities. Spices like turmeric, ginger, and clove are widely used in Ayurveda (Indian traditional medicine) and Unani (Pakistani traditional medicine), as their potential benefits for general health and well-being have long been understood. (Mohanty, 2017).

Compounds like. flavonoids, terpenoids, lignans, sulfides, polyphenolics, carotenoids, coumarins, saponins, plant sterols, and phthalides are present in the majority of regularly used Indian spices. Additionally, pharmacological studies have revealed that these compounds have anti-cancer, immune-stimulating, anti-inflammatory, anti-microbial, and antioxidant properties. They also guard against heart conditions, conditions of the central nervous system, and other chronic illnesses. Due to their positive effects that are being documented daily against many diseases, spices are receiving more attention in the present period (Ogbunugafor et al., 2017). India is known around the world for its spices and traditional medicines, which have a variety of physiological and pharmacological qualities. The

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word "species," which was used in the middle centuries to refer to groups of unusual foods, is where the word "spice" originally came from. Following the introduction of the Muslims, Indian spices gained fame nationwide and were given a specific place in Muslim cuisine. Indian spices were an important component of a more prosperous economy even in the ancient and medieval periods.

A variety of states of India are renowned for serving as the hub of the spice trade, including Kerala, Punjab, Gujarat, Manipur, Mizoram, and Uttar Pradesh. These spices are beneficial to health due to their high therapeutic value (Sharma et al., 2017). "Spices and Condiments" are described as "such natural plant or vegetable products or mixtures thereof in either whole or ground form which are used for delivering taste, scent, and piquancy to and for flavoring foods" by the International Organization for Standardization of Spices. Many common cooking spices, including clove, cinnamon, fenugreek, cardamom, ginger, and garlic, have medicinal effects. The different therapeutic effects of these cooking spices are given below.

ALLIUM SATIVUM L

The common name is garlic. It belongs to the family Amaryllidaceae and is characterized by its pungent and distinct aroma. It is a pungent bulbous crop that originates from central Asia. Its applicability extends to culinary and therapeutic purposes where it has been utilized as a traditional medicine for the treatment of various ailments (Prajapati et al., 2022). In the present day, the cultivation of garlic continues to thrive, notably in the regions of Asia, the Mediterranean, and North and South America. China is widely recognized as the foremost global producer.

This familial group comprises approximately 700 distinct species that enjoy a global distribution and are highly esteemed for their palatability, cultivational simplicity, and protracted periods of storage (Marsic et al., 2019). The culinary application of garlic extends beyond its ability to enhance the taste of food, serving instead as a predominant digestive aid in cooking, as evidenced by extensive usage patterns. To fulfill the growing demands of the consumer base, a diverse range of garlic products including garlic paste, garlic powder, garlic vinegar, harvested garlic, and garlic slices have been made available in food retail establishments (Abdelrahman et al., 2021). For millennia, humans have utilized a diverse array of biological sources, including plants, animals, and microorganisms, in their unprocessed form, such as crude extracts, to address and diagnose various ailments (Hussain et al., 2020). Garlic, in the majority of states in Nepal and India, is colloquially referred to as "Lashun".

The potential therapeutic benefits of garlic have long piqued human curiosity, spanning various periods of history. *Allium sativum* is a commonly utilized condiment that encompasses numerous bioactive constituents, including but not limited to phenolic compounds, saponins, organic sulfides, saponins, and polysaccharides. Garlic has been noted for its numerous health benefits, including anti-atherosclerotic, anti-hypertensive, anti-microbial, hypoglycemic, hypolipidemic, anticancer, anti-coagulant, and hepatoprotective effects. The underlying mechanisms that are responsible for such circumstances have yet to be determined, as indicated by previous studies.

Anti-diabetic

The oral administration of garlic extract demonstrated a significant reduction in total cholesterol, serum glucose, urea, uric acid, triglycerides, aspartate aminotransferase, and alanine aminotransferase levels, alongside an elevation in serum insulin levels. Garlic extract was comparatively investigated with glibenclamide, and it was observed that garlic extract exhibited a more potent anti-diabetic effect in comparison to glibenclamide (Singh & Singh 2019).

Anti-hypertensive

Garlic has been employed since ancient times as a means of preserving health and treating illness. Its multifunctional utility has made it a sought-after addition as a spice in culinary preparations as well as a medicinal remedy, marking its extensive usage for over five millennia. Garlic has been recommended for various medicinal purposes, particularly for circulatory conditions, as evidenced in some of the earliest medical literature. According to Hippocrates, the progenitor of modern medicine, garlic was utilized as a diuretic during the era of ancient Greece. Garlic has been extensively utilized for its immune system support and digestive properties, while its impact on cardiovascular health is comparatively limited (Ibraheem & Saeed 2023).

Subsequent studies have revealed that garlic possesses hypertensive effects on blood pressure. The activation of angiotensin II is impeded by allyl methyl sulfide (AMS) and diallyl sulfide (DAS), thus preventing the progression of the cell cycle and migration in aortic smooth muscle cells. The researchers observed that the two tested organic solar cells (OSCs) effectively hindered the reactive oxygen species (ROS) production initiated by angiotensin II. Consequently, the outcomes of their investigation suggest that AMS and DAS, chemical compounds obtained from garlic, may serve as efficacious antioxidants that specifically target arterial thickening, commonly observed in hypertension (Bhandari, 2012). Chronic ailments, specifically hypertension, diabetes mellitus, obesity, hyperlipidemia, and consequential

complications such as myocardial infarction and cerebrovascular accidents, pose significant health risks to individuals that persist over time. The management of diseases, from initial diagnosis through treatment, necessitates a significant investment of time, resources, and financial capital. In addition, unmanaged chronic illnesses can have detrimental effects, endangering the health and standard of living of everyone afflicted. People are now more conscious of diseases, which encourages them to actively take steps to avoid their beginning and any related problems. It has been shown that the effect of the reduction is greater than that of a placebo, particularly when one considers that the average drop in blood pressure resulting from garlic consumption is approximately 6 to 7 mmHg in diastolic blood pressure (DBP) and 8 to 10 mmHg in systolic blood pressure (SBP).

Effect on gut microbiota

A group of bacteria known as gut microbiology thrive in the human gut and have a strong bond with their host. Although many other species of bacteria also live in the human gut, Bacteroidetes and Firmicutes are important members of the gut microbiota (Scazzocchio et al., 2020). Garlic supplements cause Prevotella to decline and Lachnospiraceae to increase simultaneously. Lachnospiraceae is the taxonomic order containing a commensal microbial community that is primarily found in the gastrointestinal tract and is essential to the synthesis of short-chain fatty acid substrates. According to earlier studies, short-chain fatty acids (SCFAs) are the colonic epithelial cells' primary source of nutrition and have anti-inflammatory qualities in the gastrointestinal system. (Vacca et al., 2020).

SYZYGIUM AROMATICUM

The common name of this plant is clove. The dried fragrant flower buds of a Myrtaceae tree, which are primarily found in Indonesia, are what are used to make this priceless and valuable spice.

Traditional uses

Cloves have a number of medicinal properties such as pain reliever, aesthetic, antimicrobial, antidotal, anti-oxidants, relieving flatulence, and giving gastrointestinal advantages. Cloves contain numbing characteristics that can be used to treat a variety of dental problems, including toothaches. They are beneficial for the heart, liver, and stomach and also aid with memory and blood circulation.

Effect on the gastrointestinal tract

Numerous stomach-related conditions, including pain in the middle part of the stomach and stomach ulcers, can be successfully treated with cloves. Eugenol is used in orthodontic therapies because it possesses local sedative and disinfecting characteristics (Nurdjannah & Bermawie 2012). A significant source of phenolic chemicals such as flavonoids, hydroxybenzoic acids, hydroxycinnamic acids, and hydroxyphenyl propens is the spice clove. Eugenol is the main medicinal substance found in cloves. The phenolic acid with the greatest proportion is gallic acid. The clove contains up to 18% aromatic oil. Eugenol makes up around 89% of the clove essential oil, while eugenol acetate and caryophyllene make up the remaining 5% to 15% (Jirovetz et al., 2006).

CUMINUM CYMINUM

Cinnamon (*C.*) *siminum*, sometimes referred to as cumin or just "cumin," is a highly valued spice that is utilized in many different culinary applications and is noted for its unique aroma (Fatima et al., 2018).

Anticancer activity

Medical science faces a formidable challenge in addressing the escalating spread of cancer. This disease, which has been proliferating at an alarming rate, necessitates urgent and comprehensive attention from the healthcare community delineated the concept of the world (Yimer et al., 2019). The aforementioned phenomenon constitutes a principal cause of mortality and the populace's demographic levels. The prevalence of cancer, in addition to the incidence of newly diagnosed cases, continues to exhibit an upward trend. Anti-carcinogenic secretin is produced in the glands. The enzymatic activity is found to be enhanced as a result of the detoxifying and chemo-preventive attributes exhibited by the concerned compounds.

The investigation demonstrated potent anti-neoplastic attributes. The prevention of cancer cells found in the breast and colon may be attributed to the utilization of *C. Cumin* (Prakash & Gupta 2014) is a commonly used spice in Indian and Middle Eastern cuisines, and is derived from the seed of the *C. cyminum* plant. It has been demonstrated to decrease the functionality of certain enzymes, including β-enzyme.

The enzymatic activity of glucuronidase and the presence of mucins play a significant role in safeguarding the integrity of the colon. The hydrolysis process is augmented by the mucinase enzyme. In the colonic environment, an increase in β-glucuronidase activity may potentially enhance the degradation of protective mucins. The hydrolysis of glucuronide conjugates results in the liberation of toxins. The diet containing cyminum powder at a concentration of 1.25% has been noted for its remarkably advantageous properties.

Anti-diabetic

In the context of physiological measurements, various parameters have been found to manifest in the form of altered body weights, hyperglycemia, depressed blood urea levels, and low rates of excretion of urea and creatinine. *C. cyminum* (0.5% g) per kg body weight orally directed in rats with induced diabetes is described to decrease blood glucose levels. It might be due to suppression of aldose reductase and alpha-glucosidase (Patil et al., 2017). The retrieval of the reserved glycosylated hemoglobin is observed to bring about a reduction in the levels of both blood glucose and creatinine, as well as blood urea.

CINNAMOMUM VERUM

Commonly known as Cinnamon. Spices like cinnamon are frequently used in cooking. India, Sri Lanka, Bangladesh, and Nepal are the primary countries where (*Cinnamomum verum* or *C. zeylanicum*) is found. The Lauraceae is its family. It is also referred to as kurundu and dalchini in Hindi.

Therapeutic uses

This spice is known to reduce fever, is capable of reducing heat in the body, act as an antibacterial, and is capable of reducing swelling. relieve flatulence, induce perspiration, fungicidal, stimulant, and stomachic properties. Cinnamon root powder mixed in water is used to cure head pain and nerve pain. In order to encourage proper blood flow and digestion, ginger and cinnamon are combined (Das et al., 2016). Many people of Kashmiri heritage also consume cinnamon, which is known to treat diseases that are transmissible. It is acknowledged as a traditional remedy for malignancies, specifically those of the liver and abdomen.

It helps the body's own insulin synthesis. Type 2 diabetics can reduce their blood sugar levels by using half a teaspoon of cinnamon powder (Jain & Bagler 2015). Several resinous substances, including cinnamaldehyde, cinnamate, cinnamic acid, and various oily substances, make up cinnamon. cinnamon extracts, including ether, aqueous, and methanolic extracts, have demonstrated significant antioxidant properties. Cinnamon contains a variety of flavonoids, some of which are antioxidants and have the ability to eliminate free radicals. Many flavonoid substances have been identified that have anti-inflammatory properties, including gossypin, gnaphalin, hesperidin, hibifolin, hypolaetin, oroxindin, and quercetin. The lipid profile of mice improved efficiently with cinnamon, HDL level reduced, and triglyceride level decreased. Another investigation indicated that LDL, triglycerides, and total cholesterol were all decreased after giving 15% cinnamon cassia powder for 35 days to rats. In dogs and guinea pigs under anesthesia, cinnamon aldehyde causes low blood pressure effects, which may be primarily caused by peripheral vasodilatation. Dogs' cinnamaldehyde-induced vasodilatation persisted throughout the duration of time it took for their blood pressure to return to normal. Cinnamaldehyde's capacity to have a vasodilatory effect may be due to the fact that it prevents both Ca2+ inflow and Ca2+ release.

CURCUMA LONGA L

It is commonly known as turmeric. The "Indian saffron" or roots of *Curcuma longa* L. (Zingiberaceae) are the source of turmeric. It is sometimes referred to as the "Golden Spice of India".

Medicinal uses

It has been used traditionally as a home treatment for a number of illnesses including arthritic conditions sinusitis, eating disorders, sneeze wounds caused by diabetes, liver diseases, and biliary disorders (Rathaur et al., 2012). Additionally, it plays a significant part in the management of several CNS illnesses. It exhibits neuroprotective activity in conditions including dementia, severe depression, epileptic seizures, Parkinson's disease, Huntington's, head trauma, and stroke as well as other neurological and neuropsychological illnesses (Kulkarni & Dhir 2010). The polyphenolic chemicals in turmeric, especially curcumin, are primarily responsible for its neuroprotective properties. It possesses strong anti-inflammatory, antioxidant, and beta-amyloid aggregation-reducing properties (Ringman et al., 2012). It aids in treating skin issues. Cuts and wounds can be treated using turmeric powder. Additionally, it makes managing diabetes simpler. The primary component of turmeric is curcuminoids, which have a variety of therapeutic uses. Both turmeric protein and curcumin have antioxidant properties. Strong reactive oxygen and nitrogen species scavengers like curcumin include hydroxyl and nitrogen dioxide radicals. As a relaxant, anti-oxidant, anti-diabetic, and cancer-fighting agent, it serves a variety of purposes (Fadus et al., 2017). Numerous illnesses have been reported to respond well to curcumin treatment, including rheumatoid arthritis, a burning inside illness, dementia, and common cancers including colon, stomach, lung, breast, and skin-related disorders.

ZINGIBER OFFICINALE

It is a perennial herb in the Zingiberaceae family that is commonly known as ginger. This is used in cooking as a spice and seasoning. Furthermore, ZOR is extensively employed in India's pharmaceutical sector (Babu et al., 2016). The results imply that ginger has a noteworthy impact on cholesterol. Previous research has shown that both low-density lipoprotein cholesterol (LDL-C) and triacylglycerol (TAG) levels can positively change (Rauf et al., 2022). The anti-inflammatory and

anti-inflammatory qualities of ginger may have therapeutic benefits for human health.

GIT cancer

Gastrointestinal malignancies are a class of tumors that target numerous digestive system organs as well as the lining of the stomach. It comprises an array of cancers which includes esophageal, liver, stomach, gall bladder, biliary tract, pancreatic, colorectal, small bowel, anal, neuroendocrine tumors (NETs), and gastrointestinal stromal tumors (GIST). The modulation of numerous signaling molecules through the regulation of protein expression levels - both upregulation and downregulation - has been demonstrated by the various components and extracts found in ginger, depending on the target and cellular context. Several diverse targets have been identified in various cancer models, encompassing protein kinases, cell cycle regulatory proteins, transcription factors, enzymes, and growth factor receptors.

FENUGREEK

Fenugreek belongs to the family Fabaceae. Fenugreek, also known as methi, is a kind of seed that is typically used as a spice in Indian cuisine.

Therapeutic uses

It stimulates sexual desire, astringent, demulcent, carminative, stomachic, diuretic, emmenagogue, emollient, expectorant, lactogogue, restorative, and tonic in medications. Various ailments are also treated with fenugreek, namely diabetes, ulcers, lung disease, symptoms of menopause, throat irritation, high temperatures, infections, swollen glands, infections caused by tuberculosis, arthritis, digestive problems, and other infections. The brewed mixture of leaves is gargled to cure mouth ulcers. It also resolves issues with lowering blood pressure and glucose levels. Breast milk can be increased by drinking fenugreek seed tea or eating sweet fudge (Suresh et al., 2012). Galactomannans, isoleucine, and steroidal sapogenins are three important components of fenugreek that have healing properties. Fenugreek is one of the most commonly recognized "nutraceuticals" or health food products because of these ingredients, which appear to interact together synergistically to provide positive effects on well-being (Beyzi et al., 2017). Alkaloids, flavonoids, and saponins all have anti-inflammatory, anti-cancer, and anti-diabetic characteristics. The primary component of fenugreek that has anticancer effects is diosgenin.

TRACHYSPERMUM AMMI

Its common name is Ajwain, and its family name is Umbelliferae or Apiaceae. It was grown in India. Humans eat the plant's leaves and its fruit, which resemble seeds. They taste spicy and bitter, with a flavor like anise and oregano. Since they additionally possess thymol, they have a scent that is virtually identical to thyme.

Ayurvedic medicine uses

Classical Ayurvedic medicine uses ajwain largely to treat digestive issues such as indigestion, gas, diarrhea, and colic. It serves as a cleanser, detoxifier, and antacid in Siddha medicine. Ajwain aromatic oil plays a significant role in the flavor and aroma of this product. The seeds are used as an aphrodisiac, diuretic, anthelmintic, and galactagogue. Ajwain is a likely source for the creation of nutraceuticals because of its high number of antioxidants, primarily polyphenols and flavonoids. The extraction of polyphenols and flavonoids has been reported to work better with methanol as a solvent. This could be explained by methanol's stronger polarity (Singh & Meghwal 2019).

CYMBOPOGON CITRATUS

Commonly recognized as citronella lawn or lemongrass, is a well-known species in the community. It is a member of the Gramineae botanical family, which encompasses approximately 500 cereal and 1000 herb species. The Lemon lawn, a perennial grass characterized by tufted growth habit, is resilient and impervious to decay, attaining a maximum height of one meter. It is distinguished by the presence of numerous sturdy leafy culms, which emerge from its short rhizomatous roots (Ahire et al., 2022).

Anti-oxidant activity

The pharmacological behavior of phenolic acid and flavonoids as natural anti-oxidants and free radical scavengers has generated significant interest pertaining to their potential role. The plant's composition of phenolic acids demonstrated an anti-oxidative profile.

Anti-diarrheal activity

In practical implementation, the entirety of the lemongrass stalk and leaf is subject to boiling for the purpose of creating a decoction, which is subsequently consumed as a means of alleviating diarrhea. The present study focused on the investigation of citrates stalk decoction and its primary chemical element, citral (Ahire et al., 2022).

Anti-mutagenic activity

It was discovered that the ethanolic extract of lemongrass exhibits anti-mutagenic activity against a chemical-induced mutation in the bacterial strains of *Salmonella typhimurium*, specifically TA98 and TA100.

Anti-inflammatory activity

Studies were conducted to evaluate the anti-inflammatory potential of *Cymbopogon citratus* leaf infusion in lipopolysaccharide-activated dendritic cells. This investigation highlights the potential clinical application of this plant extract as a therapeutic agent for managing inflammatory disorders, particularly those pertaining to the gastrointestinal tract.

Anti-nociceptive activity

The essential oil derived from the plant is a valuable substance of pharmaceutical and commercial interest. The compound known as citrates exhibits a noteworthy capacity for reducing pain sensitivity also referred to as anti-nociceptive activity. When conducting a comparison of results obtained from three distinct experimental models of nociception, specifically the hot-plate, acetic acid-induced writhing in mice, and formalin test, it was discovered that the essential oil has an impact on both the peripheral and central levels (Ahire et al., 2022).

Anti-hepatotoxic activity

Aqueous extracts derived from the leaves of *Cymbopogon citratus* have anti-hepatotoxic activity against cisplatin-induced hepatic toxicity in rats. Therefore, it is plausible that the aforementioned extracts possess the capability to be utilized in the treatment of hepatopathies and serve as a supplementary therapeutic agent in cisplatin-induced toxicity.

Traditional uses of lemon grass

It has been reported that lemongrass leaves possess a substantial quantity of oil, which has exhibited a variety of pharmacological activities, including antimicrobial, carminative, fungicidal, analgesic, antiseptic, astringent, bactericidal, and antidepressant properties. It exhibits antibiotic and antiseptic properties, rendering it a viable option for the treatment of ringworm and athlete's foot ailments. Lemongrass displays inhibitory activity against methicillin-resistant *Staphylococcus aureus* (MRSA) infection. This therapeutic agent demonstrates potential efficacy in treating conditions such as colitis, indigestion, and gastroenteritis. This intervention effectively mitigates the manifestations of cephalalgia, bodily discomfort, neuromuscular depletion, and psychological strain (Ahire et al., 2022).

ELETTARIA CARDAMOMUM

Its common name is cardamom. (Zingiberaceae) is referred to as the "Queen of Spices (Anwar et al., 2016)." A common spice and seasoning component is cardamom. Elaichi is the popular name for green cardamom in Marathi, Hindi, and Urdu.

Ayurvedic medicine uses

It aids flatulent stomach and appetite in anorexics. It is well known in Ayurveda for its cardiac excitation, diuretic impact, cough alleviation, and cold-fighting capabilities. It was previously used to treat kidney and bladder conditions as well as fortifying the digestive system. Indians regularly utilize green cardamom (*A. subulatum*) to alleviate intestinal problems, eye problems, breathing problems, pulmonary TB, congested lungs, and ailments of the gums and enamel of the teeth. Cold nasal medication is made by combining cardamom, neem, and camphor. Cardamom decoction can be gulped to relieve sore throats. It is supposedly used as a remedy for snake and spider venom as well as a treatment for food poisoning. Additionally, indigestion, problems urinating, pediatric diarrhea, and other GIT-related problems are all historically treated with it in Chinese medicine. When fried and mixed with milk, mastic, and sugar, the cardamom pods can be used to cure bladder difficulties. It is commonly known that cardamom seeds stimulate sexual desires. Additionally, it has good effects on memory and other behavioral attitudes and has potential activity in the increase of neurotransmitters like dopamine and serotonin (Abu-Taweel, 2018). It has calming and muscle-relaxing properties and acts as a natural memory enhancer in scopolamine-induced amnesia (Kunwar et al., 2015). The primary causes of cardamom's positive benefits are its strong antioxidant properties and phytoconstituents. Cardamom showed anti-cholinesterase, anti-oxidative, anti-amyloidogenic, and neuroprotective effects thanks to alpha-terpinol acetate (Chowdhury & Kumar 2020).

CROCUS SATIVUS

Commonly known as saffron. One of the most expensive cooking herbs and is employed in various practical applications such as food preservation, ingredient addition, pigmentation, and as a component in conventional healthcare approaches. The saffron is derived from the desiccated reproductive organ of the floral structure. The cultivation of saffron has historically focused on the production of both flowers and metabolites obtained from the desiccated stigma. Numerous studies have been conducted in the scientific literature on the role of antioxidants in lowering free radical damage and oxidative stress prevention. Additionally, a number of studies have looked into their potential as defense mechanisms against a range of illnesses and bodily degenerative problems.

Antioxidant Activity

Antioxidants have the capacity to impede the process of free radical oxidation, which is crucial in preventing age-related diseases, cancer, and other ailments. A number of researchers looked at the secondary metabolites and saffron extracts' potential as antioxidants (Cerdá-Bernard et al., 2022). Safranal, picrocrocin, and crocin are three chemical compounds found in saffron and exhibit exceptional oxidation potential. Furthermore, significant radical-clotting characteristics have been demonstrated by safranal, picrocrocin, and crocin.

Anti-inflammatory properties

Saffron extracts contain an assortment of antioxidant compounds namely, crocins, crocetin, quercetin, and kaempferol which have shown potential in preventing proinflammatory cytokine production across multiple animal models. These extracts therefore exhibit anti-inflammatory properties (Fernández-Albarral et al., 2019).

Antitumor properties

According to recent research, saffron extract has demonstrated an ability to inhibit the growth of cancer cells and impede tumor formation. Saffron extracts exhibit the ability to halt the progression of cancer cells. It has been demonstrated that the growth of tumor cells is also inhibited by saffron. Saffron carotenoids are found to effectively hinder cell proliferation in human cancer cell lines in vitro. Crocetin and crocin have been identified as potential inhibitory agents for colorectal cancer cell proliferation and invasion. Moreover, it has been observed that saffron remarkably decreases the size of tumors. It has been revealed in a studious investigation that the encapsulation of crocin in saffron also presents a preventative measure against colon cancer. The constituents of saffron namely crocetin and crocin reduce the upregulated level of metalloproteinases and urokinase by inhibiting the invasion and migration of cells of prostate cancer. Crocetin exhibits an elevated degree of anticancer efficacy by inducing a reversal of the epithelial-mesenchymal transition (EMT) process, as evidenced by the downregulation of N-cadherin and β-catenin expression, along with a concomitant upregulation of E-cadherin expression. The potential anticancer properties of saffron and its constituents are also due to their ability to interact with topoisomerase II via carotenoids, which results in the inhibition of free radical chain reactions and subsequent impact on cellular RNA or DNA production (Maqbool et al., 2022).

Antidepressant effects

The antidepressant activity of saffron stigmas, safranal, and crocin has been postulated. Crocin has the capability to inhibit the uptake of dopamine and norepinephrine, whereas safranal exhibits the ability to obstruct serotonin uptake (Maqbool et al., 2022).

REFERENCES

Abdelrahman M, S Hirata, T Mukae, T Yamada, Y Sawada, M El-Syaed & M Shigyo, 2021. Comprehensive metabolite profiling in genetic resources of garlic (*Allium sativum* L.) collected from different geographical regions. Molecules 26:14-15.

Abu-Taweel GM, 2018. Cardamom (*Elettaria cardamomum*) perinatal exposure effects on the development, behavior and biochemical parameters in mice offspring. Saudi Journal of Biological Sciences 25:186-193.

Ahire LS, RS Abhonkar & S Sawant, 2022. Review on pharmacological activity of *Cymbopogon citratus*. International Journal for Multidisciplinary Research 4:3.

Anwar F, A Abbas & KM Alkharfy, 2016. Cardamom (*Elettaria cardamomum* Maton) Oils. In: Essential oils in food preservation, flavor and safety (Preedy VR eds.) Academic Press, USA pp:295-301.

Babu KN, K Samsudeen, M Divakaran, GS Pillai, V Sumathi, K Praveen & KV Peter, 2016. Protocols for in vitro propagation, conservation, synthetic seed production, embryo rescue, microrhizome production, molecular profiling, and genetic transformation in ginger (*Zingiber officinale* Roscoe.). In: Protocols for In Vitro Cultures and Secondary Metabolite Analysis of Aromatic and Medicinal Plants: 2nd Edition (Jain S, eds): Humana Press, New York, NY. 2:403-426.

Beyzi E, K Karaman, A Gunes & SB Beyzi, 2017. Change in some biochemical and bioactive properties and essential oil composition of coriander seed (*Coriandrum sativum* L.) varieties from Turkey. Industrial Crops and Products 109:74-78.

Bhandari PR, 2012. Garlic (*Allium sativum* L.): A review of potential therapeutic applications. International Journal of Green Pharmacy 6:2.

Cerdá-Bernad D, E Valero-Cases, JJ Pastor & MJ Frutos, 2022. Saffron bioactives crocin, crocetin and safranal: effect on oxidative stress and mechanisms of action. Critical Reviews in Food Science and Nutrition 62:3232-3249.

Chowdhury S & S Kumar, 2020. Alpha-terpinyl acetate: A natural monoterpenoid from Elettaria cardamomum as multi-target directed ligand in Alzheimer's disease. Journal of Functional Foods 68:103892.

Das DR, AK Sachan, G Vishnoi, M Shuaib & M Imtiyaz, 2016. A review on surveillance of herbal medicines. International Journal of Phytopharmacology 7:68-72.

Fadus MC, C Lau, J Bikhchandani & HT Lynch, 2017. Curcumin: An age-old anti-inflammatory and anti-neoplastic agent. Journal of Traditional and Complementary Medicine 7:339-346.

Fatima T, NB Beenish, G Gani, T Qadri & TA Bhat, 2018. Antioxidant potential and health benefits of cumin. Journal of Medicinal Plants Studies 6:232-236.

Fernández-Albarral JA, AI Ramírez, R de Hoz, N López-Villarín, E Salobrar-García, I López-Cuenca & JJ Salazar, 2019. Neuroprotective and anti-inflammatory effects of a hydrophilic saffron extract in a model of glaucoma. International Journal of Molecular Sciences 20:4110.

Hussain MS, M Singh, B Kumar, D Tewari, S Mansoor & N Ganesh, 2020. Antimicrobial activity in ethanolic extracts of *Bixa orellana* L., *Simarouba glauca* DC and *Ocimum tenuiflorum* L. collected from JNCH herbal garden. World Journal of Pharmaceutical Research 9:650-663.

Ibraheem LJ & NAHAA Saeed, 2023. Advantages of Ggarlic in treating hypertension. Eurasian Medical Research Periodical 19:28-37.

Jain A & G Bagler, 2015. Spices form the basis of food pairing in Indian cuisine. arXiv preprint arXiv:1502.03815.

Jirovetz L, G Buchbauer, I Stoilova, A Stoyanova, A Krastanov & E Schmidt, 2006. Chemical composition and antioxidant properties of clove leaf essential oil. Journal of Agricultural and Food Chemistry 54:6303-6307.

Kulkarni SK & A Dhir, 2010. An overview of curcumin in neurological disorders. Indian Journal of Pharmaceutical Sciences 72:149.

Kunwar T, N Kumar & P Kothiyal, 2015. Effect of Elettaria cardamomum hydroethanolic extract on learning and memory in Scopolamine induced amnesia. World Journal of Pharmaceutical Sciences 75-85.

Maqbool Z, MS Arshad, A Ali, A Aziz, W Khalid, MF Afzal & JM Lorenzo, 2022. Potential role of phytochemical extract from saffron in development of

functional foods and protection of brain-related disorders. Oxidative Medicine and Cellular Longevity 2022:6480590.

Marsic NK, M Necemer, R Veberic, NP Ulrih & M Skrt, 2019. Effect of cultivar and fertilization on garlic yield and allicin content in bulbs at harvestand during storage. Turkish Journal of Agriculture and Forestry 43:414-429.

Mohanty B, 2017. A review on current therapies and challenges in Alzheimer's disease and role of Indian spices in its treatment as a futuristic approach. The Neurologist: Clinical and Therapeutics Journal 1:2.

Nurdjannah N & N Bermawie, 2012. Cloves. In Handbook of herbs and spices (Peter KV Eds). Woodhead Publishing, pp:197-215.

Ogbunugafor HA, CG Ugochukwu & AE Kyrian-Ogbonna, 2017. The role of spices in nutrition and health: a review of three popular spices used in Southern Nigeria. Food Quality and Safety 1:171-185.

Patil AK, RPS Baghel, S Nayak, CD Malapure, K Govil, D Kumar & PK Yadav, 2017. Cumin (*Cuminum cyminum*): As a feed additive for livestock. Journal of Entomology and Zoology Studies 5:365-369.

Prajapati MR, A Manav, J Singh, P Kumar, A Kumar, R Kumar & VK Baranwal, 2022. Identification and characterization of a garlic virus E genome in garlic (*Allium sativum* L.) using high-throughput sequencing from India. Plants 11:224.

Prakash E & DK Gupta, 2014. Cytotoxic activity of ethanolic extract of *Cuminum cyminum* Linn against seven human cancer cell line. Universal Journal of Agricultural Research 2:27-30.

Rathaur P, W Raja, PW Ramteke & SA John, 2012. Turmeric: The golden spice of life. International Journal of Pharmaceutical Sciences and Research 3:1987.

Rauf A, M Akram, H Anwar, M Daniyal, N Munir, S Bawazeer & H Khan, 2022. Therapeutic potential of herbal medicine for the management of hyperlipidemia: Latest updates. Environmental Science and Pollution Research 29:40281-40301.

Ringman JM, SA Frautschy, E Teng, AN Begum, J Bardens & M Beigi1, 2012. Oral curcumin for Alzheimer's disease: tolerability and efficacy in a 24-week randomized, double blind, placebo-controlled study. Alzheimer's Research and Therapy 4:43.

Scazzocchio B, L Minghetti & MD Archivio, 2020. Interaction between gut microbiota and curcumin: a new key of understanding for the health effects of curcumin. Nutrients 12:2499.

Sharma M, A Gupta & R Prasad, 2017. A review on herbs, spices and functional food used in diseases. International Journal of Research and Review 4:103-108.

Singh H & M Meghwal, 2019. Ajwain a potential source of phytochemical for better health. Pharma Innovation 8:599-603.

Singh R & K Singh, 2019. Garlic: a spice with wide medicinal actions. Journal of Pharmacognosy and Phytochemistry 8:1349-1355.

Sofowora A, E Ogunbodede & A Onayade, 2013. The role and place of medicinal plants in the strategies for disease prevention. African Journal of Traditional, Complementary and Alternative Medicines 10:210-229.

Suresh P, CN Kavitha, SM Babu, VP Reddy & AK Latha, 2012. Effect of ethanol extract of *Trigonella foenum graecum* (Fenugreek) seeds on Freund's adjuvant-induced arthritis in albino rats. Inflammation 35:1314-1321.

Vacca M, G Celano, FM Calabrese, P Portincasa, M Gobbetti & MDe Angelis, 2020. The controversial role of human gut lachnospiraceae. Microorganisms 8:573.

Yimer EM, KB Tuem, A Karim, Nu Rehman & F Anwar, 2019. *Nigella sativa* L. (black cumin): a promising natural remedy for wide range of illnesses. Evidence-Based Complementary and Alternative Medicine 2019:1528635.